

## CLAIMS

1. A reduction gear for a walking assistance system that, in order to assist walking movement by extending/bending a user's leg joint, reduces the speed of rotation of an input shaft (Si) driven by a motor (48) and transmits the rotation to an output shaft (So) connected to the leg joint, the reduction gear comprising:

the input shaft (Si), the output shaft (So), a first planetary gear mechanism (P<sub>1</sub>), and a second planetary gear mechanism (P<sub>2</sub>) disposed coaxially on an axis (L), the second planetary gear mechanism (P<sub>2</sub>) being disposed so as to substantially overlap the radially outer side of the first planetary gear mechanism (P<sub>1</sub>), the rotation of the input shaft (Si) being reduced in speed by the first planetary gear mechanism (P<sub>1</sub>) and the second planetary gear mechanism (P<sub>2</sub>) and transmitted to the output shaft (So);

the first planetary gear mechanism (P<sub>1</sub>) comprising a first sun gear (ZS<sub>1</sub>) provided on the input shaft (Si), a first ring gear (ZR<sub>1</sub>) rotatably disposed so as to surround the outer periphery of the first sun gear (ZS<sub>1</sub>), a plurality of first planetary gears (ZP<sub>1</sub>) meshing simultaneously with the first sun gear (ZS<sub>1</sub>) and the first ring gear (ZR<sub>1</sub>), and a first carrier (C<sub>1</sub>) rotatably supporting the first planetary gears (ZP<sub>1</sub>), and;

the second planetary gear mechanism (P<sub>2</sub>) comprising a second sun gear (ZS<sub>2</sub>) provided on the outer periphery of the first ring gear (ZR<sub>1</sub>), a second ring gear (ZR<sub>2</sub>) disposed so as to surround the outer periphery of the second sun gear (ZS<sub>2</sub>), a plurality of second planetary gears (ZP<sub>2</sub>) meshing simultaneously with the second sun gear (ZS<sub>2</sub>) and the second ring gear (ZR<sub>2</sub>), and a second carrier (C<sub>2</sub>) rotatably supporting the second planetary gears (ZP<sub>2</sub>).

2. The reduction gear for the walking assistance system according to Claim 1, wherein the first carrier ( $C_1$ ) of the first planetary gear mechanism ( $P_1$ ) is fixed to a casing (41), the second ring gear ( $ZR_2$ ) of the second planetary gear mechanism ( $P_2$ ) is fixed to the casing (41), and the second carrier ( $C_2$ ) of the second planetary gear mechanism ( $P_2$ ) is connected to the output shaft (So).

3. The reduction gear for the walking assistance system according to Claim 2, wherein a third planetary gear mechanism ( $P_3$ ) is disposed so as to be coaxial with and be stacked on the first planetary gear mechanism ( $P_1$ ) and the second planetary gear mechanism ( $P_2$ ) in the axis (L) direction, the third planetary gear mechanism ( $P_3$ ) comprising a third sun gear ( $ZS_3$ ) provided on the outer periphery of a central part of the second carrier ( $C_2$ ) of the second planetary gear mechanism ( $P_2$ ), a third ring gear ( $ZR_3$ ) fixed to the casing and disposed so as to surround the outer periphery of the third sun gear ( $ZS_3$ ), a plurality of third planetary gears ( $ZP_3$ ) meshing simultaneously with the third sun gear ( $ZS_3$ ) and the third ring gear ( $ZR_3$ ), and a third carrier ( $C_3$ ) rotatably supporting the third planetary gear ( $ZP_3$ ) and connected to the output shaft (So).

4. A reduction gear for a walking assistance system that, in order to assist walking movement by extending/bending a user's leg joint, reduces the speed of rotation of an input shaft ( $Si$ ) driven by a motor (48) and transmits the rotation to an output shaft (So) connected to the leg joint, the reduction gear comprising:

the input shaft ( $Si$ ), the output shaft (So), a first planetary gear mechanism ( $P_1$ ), a second planetary gear mechanism ( $P_2$ ), and a third planetary gear mechanism ( $P_3$ ) disposed coaxially on an axis (L), the second planetary gear mechanism ( $P_2$ ) being disposed so as to substantially overlap

the radially outer side of the first planetary gear mechanism ( $P_1$ ), the third planetary gear mechanism ( $P_3$ ) being disposed so as to substantially overlap the radially outer side of the second planetary gear mechanism ( $P_2$ ), the rotation of the input shaft ( $S_i$ ) being reduced in speed by the first planetary gear mechanism ( $P_1$ ), the second planetary gear mechanism ( $P_2$ ), and the third planetary gear mechanism ( $P_3$ ) and transmitted to the output shaft ( $S_o$ );

the first planetary gear mechanism ( $P_1$ ) comprising a first sun gear ( $ZS_1$ ) provided on the input shaft ( $S_i$ ), a first ring gear ( $ZR_1$ ) formed on the inner periphery of an inside ring member (55i) rotatably disposed so as to surround the first sun gear ( $ZS_1$ ), a plurality of first planetary gears ( $ZP_1$ ) meshing simultaneously with the first sun gear ( $ZS_1$ ) and the first ring gear ( $ZR_1$ ), and a first carrier ( $C_1$ ) fixed to a casing (41) and rotatably supporting the first planetary gears ( $ZP_1$ );

the second planetary gear mechanism ( $P_2$ ) comprising a second sun gear ( $ZS_2$ ) formed on the outer periphery of the inside ring member (55i), a second ring gear ( $ZR_2$ ) formed on the inner periphery of an outside ring member (55o) disposed so as to surround the outer periphery of the second sun gear ( $ZS_2$ ), a plurality of second planetary gears ( $ZP_2$ ) meshing simultaneously with the second sun gear ( $ZS_2$ ) and the second ring gear ( $ZR_2$ ), and a second carrier ( $C_2$ ) fixed to the casing (41) and rotatably supporting the second planetary gears ( $ZP_2$ ); and

the third planetary gear mechanism ( $P_3$ ) comprising a third sun gear ( $ZS_3$ ) formed on the outer periphery of the outside ring member (55o), a third ring gear ( $ZR_3$ ) fixed to the casing (41) so as to surround the outer periphery of the third sun gear ( $ZS_3$ ), a plurality of third planetary gears ( $ZP_3$ ) meshing simultaneously with the third sun gear ( $ZS_3$ ) and the third ring gear ( $ZR_3$ ), and

a third carrier ( $C_3$ ) rotatably supporting the third planetary gears ( $ZP_3$ ) and connected to the output shaft ( $So$ ).

5. A reduction gear for a walking assistance system that, in order to assist walking movement by extending/bending a user's leg joint, reduces the speed of rotation of an input shaft ( $Si$ ) driven by a motor (48) and transmits the rotation to an output shaft ( $So$ ) connected to the leg joint, the reduction gear comprising:

the input shaft ( $Si$ ), the output shaft ( $So$ ), a first planetary gear mechanism ( $P_1$ ), a second planetary gear mechanism ( $P_2$ ), and a third planetary gear mechanism ( $P_3$ ) disposed coaxially on an axis ( $L$ ), the second planetary gear mechanism ( $P_2$ ) being disposed so as to substantially overlap the radially outer side of the first planetary gear mechanism ( $P_1$ ), the third planetary gear mechanism ( $P_3$ ) being disposed so as to substantially overlap the radially outer side of the second planetary gear mechanism ( $P_2$ ), the rotation of the input shaft ( $Si$ ) being reduced in speed by the first planetary gear mechanism ( $P_1$ ), the second planetary gear mechanism ( $P_2$ ), and the third planetary gear mechanism ( $P_3$ ) and transmitted to the output shaft ( $So$ );

the first planetary gear mechanism ( $P_1$ ) comprising a first sun gear ( $ZS_1$ ) provided on the input shaft ( $Si$ ), a first ring gear ( $ZR_1$ ) fixed to a casing (41) so as to surround the first sun gear ( $ZS_1$ ), a plurality of first planetary gears ( $ZP_1$ ) meshing simultaneously with the first sun gear ( $ZS_1$ ) and the first ring gear ( $ZR_1$ ), and a first carrier ( $C_1$ ) rotatably supporting the first planetary gears ( $ZP_1$ );

the second planetary gear mechanism ( $P_2$ ) comprising a second sun gear ( $ZS_2$ ) formed on the outer periphery of the first carrier ( $C_1$ ), a second ring gear ( $ZR_2$ ) fixed to the casing (41) so as to surround the outer periphery of the second sun gear ( $ZS_2$ ), a plurality of second planetary gears ( $ZP_2$ ) meshing

simultaneously with the second sun gear ( $ZS_2$ ) and the second ring gear ( $ZR_2$ ), and a second carrier ( $C_2$ ) rotatably supporting the second planetary gears ( $ZP_2$ ); and

the third planetary gear mechanism ( $P_3$ ) comprising a third sun gear ( $ZS_3$ ) formed on the outer periphery of the second carrier ( $C_2$ ), a third ring gear ( $ZR_3$ ) fixed to the casing (41) so as to surround the outer periphery of the third sun gear ( $ZS_3$ ), a plurality of third planetary gears ( $ZP_3$ ) meshing simultaneously with the third sun gear ( $ZS_3$ ) and the third ring gear ( $ZR_3$ ), and a third carrier ( $C_3$ ) rotatably supporting the third planetary gears ( $ZP_3$ ) and connected to the output shaft ( $So$ ).

6. A reduction gear for a walking assistance system that, in order to assist walking movement by extending/bending a user's leg joint, reduces the speed of rotation of an input shaft ( $Si$ ) driven by a motor (48) and transmits the rotation to an output shaft ( $So$ ) connected to the leg joint, the reduction gear comprising:

the input shaft ( $Si$ ), the output shaft ( $So$ ), a first planetary gear mechanism ( $P_1$ ), a second planetary gear mechanism ( $P_2$ ), and a third planetary gear mechanism ( $P_3$ ) disposed coaxially on an axis ( $L$ ), the second planetary gear mechanism ( $P_2$ ) being disposed so as to substantially overlap the radially outer side of the first planetary gear mechanism ( $P_1$ ), the third planetary gear mechanism ( $P_3$ ) being disposed so as to be stacked on the first planetary gear mechanism ( $P_1$ ) and the second planetary gear mechanism ( $P_2$ ) in the axis ( $L$ ) direction, the rotation of the input shaft ( $Si$ ) being reduced in speed by the first planetary gear mechanism ( $P_1$ ), the second planetary gear mechanism ( $P_2$ ), and the third planetary gear mechanism ( $P_3$ ) and transmitted to the output shaft ( $So$ );

the first planetary gear mechanism ( $P_1$ ) comprising a first sun gear ( $ZS_1$ ) provided on the input shaft ( $Si$ ), a first ring gear ( $ZR_1$ ) fixed to a casing (41) so as to surround the outer periphery of the first sun gear ( $ZS_1$ ), a plurality of first planetary gears ( $ZP_1$ ) meshing simultaneously with the first sun gear ( $ZS_1$ ) and the first ring gear ( $ZR_1$ ), and a first carrier ( $C_1$ ) rotatably supporting the first planetary gears ( $ZP_1$ );

the second planetary gear mechanism ( $P_2$ ) comprising a second sun gear ( $ZS_2$ ) provided on the outer periphery of the first carrier ( $C_1$ ), a second ring gear ( $ZR_2$ ) fixed to the casing (41) so as to surround the outer periphery of the second sun gear ( $ZS_2$ ), a plurality of second planetary gears ( $ZP_2$ ) meshing simultaneously with the second sun gear ( $ZS_2$ ) and the second ring gear ( $ZR_2$ ), and a second carrier ( $C_2$ ) rotatably supporting the second planetary gears ( $ZP_2$ ); and

the third planetary gear mechanism ( $P_3$ ) comprising a third sun gear ( $ZS_3$ ) provided on the outer periphery of a central part of the second carrier ( $C_2$ ), a third ring gear ( $ZR_3$ ) fixed to the casing (41) so as to surround the outer periphery of the third sun gear ( $ZS_3$ ), a plurality of third planetary gears ( $ZP_3$ ) meshing simultaneously with the third sun gear ( $ZS_3$ ) and the third ring gear ( $ZR_3$ ), and a third carrier ( $C_3$ ) rotatably supporting the third planetary gears ( $ZP_3$ ) and connected to the output shaft ( $So$ ).